Dynamics of reproduction and development of weight in the Wild boar *(Sus scrofa)* in South-west France

By Dominique Pépin, F. Spitz, G. Janeau and G. Valet

Institut National de la Recherche Agronomique, Castanet-Tolosan, France

Receipt of Ms. 25. 3. 1986

Abstract

Studied was the weight and reproductive stage of wild boar in relation to age and food conditions. 133 data were obtained between 1978 and 1981, among which 65 (49 %) relevant to tagged animals. Age of most animals was determined by reference to their lens weight at death. Results indicate that the body weight evolution is similar in both sexes until they reach about 45 kg at 12–15 months. Males maintain a fast weight gain while a tendency to a step by step change is observed in females, as a consequence of their annual investment in breeding. After a big oak mast, adults are heavier and the births occur earlier: this last fact is the only responsible of heavier piglets observed at the next hunting season.

Introduction

In the domestic sow, puberty occurs at an age which is characteristic of each bred, provided weight growth has not been too much slower than the average (Etienne and Legault 1974). If young sows are subject to important food deficiency just before puberty or even earlier, their body development is slowed down and their first oestrus delayed (Duncan and Lodge 1960: in Sadleir 1969; Zimmerman et al. 1960; Duée and Etienne 1974; Etienne et al. 1983). A more energetic diet given sows just before mating results in a significant increase of ovulation rate (the so-called "flushing") as told by Sorensen et al. (1961).

In the wild sow, Oloff (1951) reports that many young females may breed at 8–10 months old when good oak or beech mast occurs but not when mast is poor. He also precises that the rate of reproduction increases in years of plenty. Matschke (1964) made equivalent observations, speaking of the so-called "flushing effect" of food. Henry (1966), Briedermann (1971) and Aumaître et al. (1984) observe that an increase in food supply results in higher litter size. Food excess or deficiency can also be involved in the timing of anoestrus-oestrus transition in autumn (Mauget 1980; Aumaître et al. 1982). Actually, while the domestic sow is continuously fertile with some fluctuations (Martinat-Botte et al. 1981, 1984), the wild sow is sexually seasonal, whatever the quantity of food offered. On the other hand, weight development in wild boar (male or female) is affected to a certain extent by food conditions in the wild (Oloff 1951; Kozlo 1975; Klein 1984). Relationship of food, weight and reproduction in the wild boar has never been considered in detail. The present work is an attempt to analyze this complex dynamics, on the basis of observations collected in the wild in South West France.

U.S. Copyright Clearance Center Code Statement: 0044-3468/87/5201-0021 $ 02.50/0
Z. Säugetierkunde 52 (1987) 21–30

ISSN 0044-3468

Material and methods

Study area

Grésigne country, located in adjacent parts of Tarn and Tarn-et-Garonne departements, extends over about 350 square km. It presents a hilly landscape varying in altitude from 100 to more than 500 m above sea level. On an economical viewpoint, it is considered as "marginal" and qualified "piedmont" or "mountain". The entire area is characterized by an important forest cover (more than 50 %), scattered farmland patches dominated by forage cultivation, and a large proportion of more or less recently abandoned rangeland. "Gaillac" brand vineyards extend over the extreme south of Grésigne. Center of Grésigne is occupied by a State Forest (35 square km). All woodlots in the country present a diversified understory, with several important evergreen species. A small number of plots are planted with conifers, mixed with dense scrub vegetation. Dense understory and scrubland are highly favourable to the establishment of wild boar resting places. Wild boars are also provided with abundant food resource: acorn, chestnuts, grapes, several species of wild fruit, herbs and legumes. During the study, an exceptional oak mast occurs in autumn 1978. Wild boar hunting is performed by specialized teams (hound hunting with posted shooters). Hunting effort is high, rather constant year after year and uniformly distributed. Hunting bag is estimated 200–250 for the 350 square km of Grésigne country. Wild boar population density has been estimated about 2 to 3 per square km in summertime. (Spitz et al. 1984).

Trapping and handling live animals

Small (8 square m) and corral-type (500 square m) traps have been located in the State Forest. Animals less than 30 kg are immobilized with a small net. Others are forced into a handling box, or chemically immobilized. For each animal date, place, weight, sex, apparent reproductive state are recorded. In addition blood samples and ectoparasites are collected. An ear tag (numbered plastic tag) is placed. 87 individuals have been ear tagged, among them 15 received a radio-collar. All are released at trapping place.

Ear-tag recovery and examination of dead animals

At the onset of trapping work in Grésigne, a large information campaign was organized in neighbouring departements of Tarn, Tarn-et-Garonne and Haute-Garonne, in newspapers, by direct contact with hunting teams and through hunting organizations and game keepers. Hunters were requested to record identification number of the tag, sex and weight of tagged animals they killed, place and date of the shot, and to collect eyes in formaline (containers with formaline had been distributed prior to the hunting season). In addition to this large-scale survey, our team conducted regular observations on animals shot in Grésigne State Forest during the 78–80 seasons: for each animal some additional informations were recorded (macroscopic examination of reproductive apparatus, stomach content, dentition, ectoparasites) and female reproductive tracts were collected and examined later. Ovaries were weighed and observed with binocular microscope. Uterus was dissected in search of embryos and placental scars. Age of embryos was deducted from their length according to Henry's (1968) formula.

Age determination

Age classification in live animals is usually based upon body size or general morphology. However Dardaillon (1984) considers as known age animals only those piglets distinctly striped, and similarly Klein (1984) places in this category only piglets less than 10 kg. For dead or live animals, an usual technic is based on milk tooth eruption and replacement, according to a key published by Matschke (1967). Age determination following this method is approximative and relies upon a subjective decision (Sweeney et al. 1970). Following indications from Quéré (pers. comm.) we selected eye lens weight as an age criterion similarly to El Mastour et al. (1982) and Dardaillon (1984). All these authors propose approximately the same figures as those published by Spitz (1984). This author's results are summarized by the following formula:

$$y = \exp \frac{x + 522}{155}$$

where y is age in days and x weight of both lenses in mg.

When this technic is applied to an individual, uncertainty of this estimation is ± 1 month at 6 months, ± 2 at 12 months and ± 4 at 2 years (Spitz 1984). When applied to large samples it gives a good approximation of the average birth date. This practically applies to the general aspect of age

distribution (one or several peaks?) and allows to evaluate the average age (average birth date) corresponding to each peak.

In the present study we consider as known age animals those ones the lenses of which were weighed. Age at trapping is deducted from age at death. This basic set is completed by some individuals trapped as striped piglets among a family group (very small animals of same weight and general appearance), but the lens of which were not collected at death.

Treatment of informations about reproduction

According to Aumaître et al. (1982), females are classified as "cyclic" or "inactive" following weight of ovary and empty uterus. Rythmicity of birth is deducted from the trapping rate of young piglets and from estimated age of dead animals. Fertility (litter size) and embryonic losses are evaluated.

Treatment of informations about weight gain

General age distribution of animals examined in Grésigne is presented in Table 1. Due to incertainty in individual age determination, animals were grouped in successive age classes of increasing width. We first notice in Table 1 that data concerning hunted animals are the most numerous (71,4 % of the total). Secondly, we observe that trapped animals are mostly piglets less than 5 months old (81,6 %), while hunted animals are very few in this age class (6,3 %). Finally, the whole set of data can be

Table 1

Distribution of age, sex and types of wild boars examined in the Grésigne State Forest between 1979 and 1981

Age class (month)	Lens weight (mg)	Shot(1)				Caught in traps				total	
		untagged		tagged		type A(2)		type B(3)			
		♂	♀	♂	♀	♂	♀	♂	♀	♂	♀
1– 2						–	2	2	2	2	4
2– 3						2	4	8	3	10	7
3– 4	176–219	–	1			–	3	–	1	–	5
4– 5	220–254	1	3	–	1	2	1	1	–	4	5
5– 6	255–283	7	2	–	3					7	5
6– 8	284–328	4	8	0+1(4)	–					5	8
8–10	329–362	4	3	3	1	3	–			10	4
10–12	363–390	1	–	1	–	1	–			3	–
12–15	391–425	1	2	1+2	–	2	–			6	2
15–18	426–453	–	9	1+1	3					2	12
18–24	454–497	6	3	4+1	2					11	5
24–36	498–560	1	3	1*	–	1	–			3	3
>36	>560	4	5	1	–					5	5
Total		29	39	12+5	10	11	10	11	6	68	65

(1) age determined by lens weight, (2) age at capture determined a posteriori by lens weight, (3) caught at the same time as another animal of the latter category, (4) age at capture + time between capture and shooting, (*) animal caught as a juvenile and shot 760 days after

divided in 38 (28,6 %) individuals weighed at trapping, 27 (20,3 %) tagged individuals recaptured by shooting and 68 (51,1 %) untagged animals weighed at death. From 86 wild boars tagged in the 78–81 period, 39 (45 %) were recaptured (Spitz 1984). In addition to 21 animals the age of which was estimated by eye lens weight, the age of 6 males was evaluated. Finally, among 39 recaptured animals 27 have been successfully aged (69 %).

For each age class male and female weights are compared by utilizing Student's test when variances are equal (F of Fisher-Snedecor) or the test of Sukhatme when variances are unequal. When unsignificant difference between sexes is observed, results from both sexes are grouped.

Results

Reproduction

Characters of genital tracts

At infant stage, for a body mass of about 30 kg, average ovary weight is about 1 g. The same value is observed in females 1 to 2 years old when sexually inactive. In females older than 2 years ovaries of sexually inactive individuals is a little bit heavier (1,75 g; significant difference at 0.01 level). As soon as cyclic, or at the beginning of pregnancy, animals present ovaries weighing 3 g (significant difference at 0.01 level; Fig. 1).

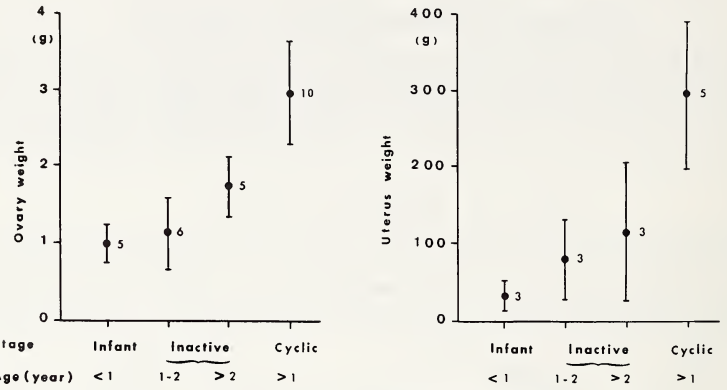

Fig. 1. Development of ovary weight and uterus weight in relation to age and stage of females

Evolution of uterine weight

At infant stage, uterine weight averages 40 g. In sexually inactive famales 1 to 2 years old, it increases up to 80 g ($P < 0.01$), and up to 120 g ($P < 0.05$) in older females. When cyclic females present significantly heavier uterus, with an average 300 g (Fig. 1). During pregnancy, development of uterus and foetal annexes goes on: in a female with 6 embryos 45 days old, total weight of uterus, embryos and annexes was 1436 g.

Onset of oestrus and pregnancy

The following observations concern only females older than 1 year examined during 78–79 and 79–80 hunting seasons. During the first campaign, among 5 females (15–18 months old) dissected in october, 2 show ovulations and another (2–3 years old) is pregnant. Three individuals examined in November-December are pregnant, the younger in the 12–15 month age class. During the 79–80 season, all 4 females observed in October-November (among which 2 older than 3 years) are sexually inactive. Among 7 females examined in December, only 3 are cyclic but without any sign of pregnancy.

Birth date

In 1978, all 8 piglets observed in the game bag were born in May-June. In 1979 births are more widely distributed, from January-February to July-August. In 1980 again, birth dates are restricted to a limited number of months (Fig. 2).

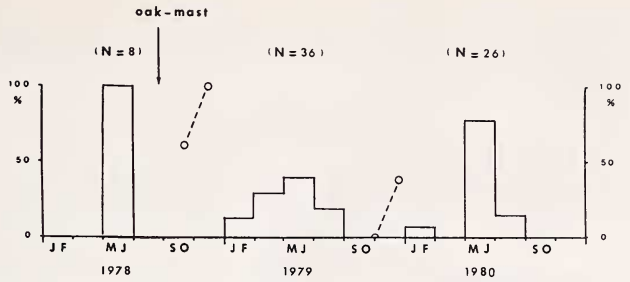

Fig. 2. Chronology of reproduction in wild boar from 1978 to 1980. Histogram of frequency of birth dates of piglets and percentage of observed ovulating or pregnant females (circles). Arrow points to oak-mast in autumn 1978

Body weight development

Relation to sex

Generally speaking, weight of male and female piglets of the first age class (1–2 months) is close to 5 kg. Weight gain is fast up to 1 year, when both sexes reach about 45 kg. During the 2nd year, weight dynamics change in relation to sex (Fig. 3). Males 1 to 2 years old maintain a fast weight gain, while females stay approximately at the same level. It results in

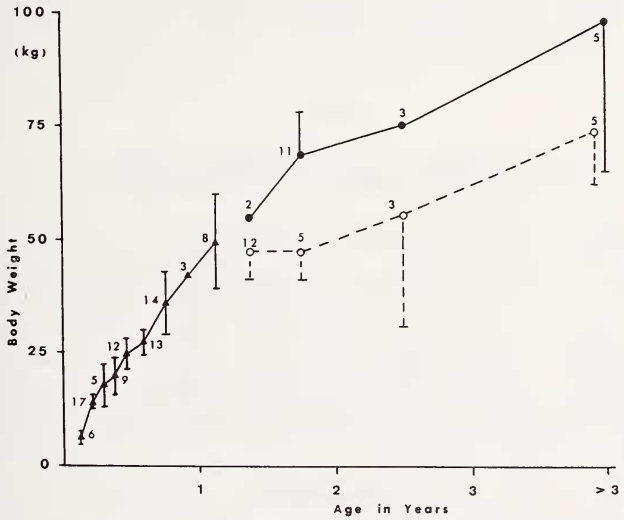

Fig. 3. Development of body weight in relation with age and sex of animals. ▲—▲: males + females; ●—●: males; ○–○: females

an average difference in weight between sexes climbing up to 20 kg at the end of the second year. Afterwards males and females go on increasing in weight at similar rates so that animals older than 3 years present an average 100 kg in males and 75 kg in females. Difference between sexes stays highly significant ($P < 0.01$).

Fig. 3 shows that body growth in piglets, as well as in older males, is regular. If hypothesizing that weight varies at a constant rate, daily weight gain would be about 110 g.

Fig. 4 presents the relative weight gain curve (monthly weight gain divided by actual

weight at the beginning of the month). Piglets show an increase rate of 26,3 % per month in the interval 2–3 months, decreasing down to 6,3 % in the interval 14–15 months.

In older animals a further decrease is observed, with a tendency to a step-by-step change in females.

Fig. 4. Relative body weight gain between 2 and 15 months (in g/100 g of initial weight)

Influence of food resource

An exceptional oak mast in 1978 resulted in an abundant food resource up to summer 1979. Individuals able to take advantage of it are, first, piglets in their rapid growth stage and, second, older animals. In order to test a possible effect of this oak mast on both categories, we compare in Table 2 the average body weights of animals killed in 1979 to those in 1978 (prior to having taken advantage of acorn fall).

Data available for piglets do not allow to demonstrate a significant difference between 1978 and 1979 for age classes 5–6 months and 6–8 months. For adults comparison concerns females 1 to 2 years old, and male 18 months–2 years. Individuals killed in 1979 are significantly heavier, with a difference greater for males (about 20 kg, $P < 0.01$) than for females (about 10 kg, $P < 0.05$).

Table 2

Comparison of average body weigth in various categories of wild boars in the Grésigne State Forest, in relation to food conditions

Sex	Age class	Oak-mast in previous autumn						t test
		scarce			abundant			
		N	$\overline{M}$	S.D	N	$\overline{M}$	S.D	
♂+♀	5–6 months	7	25.9	4.0	5	23.6	9.0	t = 1.8 ; NS
♂+♀	6–8 months	4	26.0	5.0	9	27.9	3.9	t = 1.2 ; NS
♀	1–2 years	8	42.6	4.6	11	51.3	5.0	t = 28 ; P < 0.05
♂	1.5–2 years	4	61.1	7.7	7	81.0	17.0	t = 7.9 ; P < 0.01

Discussion

Methodological aspects

Results of this study, realized from data collected in live and/or dead animals are not exempt of criticizism. Let us first notice that most trapping take place in the March-September interval, while hunting season is limited from October to early January. A bias can thus be introduced by a seasonal cycle of the weight variation as observed in captive males fed ad libitum (Mauget et al. 1984), or in wild animals of East France (Klein 1984). Let us also remind that age distribution of our two samples are dramatically different: it should be verified whether the adult seasonal cycle of weight gain (or loss) is similarly observed in piglets up to 1 year, or not. Moreover, when working with a completely wild population of boars, we must accept some unaccuracies, for instance when ageing

individuals more than 1 year. Grouping in classes decreases this bias, provided a sufficient number of animals in each class: it is not always the case in our study.

Reproduction

As in the domestic sow (Josse et al. 1979), observing and weighing ovaries and uterus allow to quickly determine the physiological state of the wild sow. Evolution with age, stage and season, observed in the present study is quite comparable to Aumaître's (1982) results. In addition to this author, we observed, by separing females less than 2 years and older, that ovary and uterus of inactive ones are heavier in the second category.

The onset of the seasonal breeding activity is strongly related to food availability. Matschke (1964) particularly mentions that an important food deficiency results in maintaining females in anoestrus. Conversely, an exceptional food resource, like oak or beech-mast, coincides with an earlier onset of oestrus.

However, even in this case, a seasonal anoestrus phase occurs (in the northern hemisphere) in the July-September interval as revealed by hormonal profiles in Mauget (1982). Present observations indicate that the exceptional 1978 oak mast in Grésigne resulted in earlier births (likely as soon as January 1979).

If we hypothesize a pregnancy length of 115–120 days (Henry 1968; Mauget 1972; Vericad 1983), we estimate that the first fertile matings occured in the second half of September 1978, i.e. as soon as oestrus phase was able to begin. Due to a too small number of observations, our work cannot provide new elements concerning fertility or litter size increase in the case of food abundance. However this phenomenon has been frequently demonstrated, by directly recording ovulation rate and embryo number (Henry 1966; Briedermann 1971; Stubbe and Stubbe 1977; Aumaître et al. 1982) or pregnancy rate (Singer and Ackermann 1981) or by observing sows with youngs (Oloff 1951; Matschke 1964; De Vos and Sassani 1977).

Weight growth in piglets and weight of adults

In consequence of the difficulty of repeatedly measuring wild animals, data concerning growth rates are rare. In wild boar, Mauget (1980) observes that piglets from the captive population of the Chizé forest exhibit a linear ponderal development, averaging 2.9 kg per month up to 6 months. In a more detailed study encompassing 4 different forests in East France, Klein (1984) shows that actually growth rate of piglets is rather variable from one place to another, seemingly due to the "potential value" of each ecosystem. However, in a given place, he does not find any significant difference between successive years, up to the age of 6 months. This author also stresses that growth rate is similar in males and females as long as they do not reach 45 kg, i.e. approximately at the age of 12–15 months. Our own observations, although in good accordance with the above cited, lead to think that weight increase in piglets would tend to be linear up to the end of this "unisex" growth phase. Furthermore, our study shows that existence or absence of big oak mast does not affect the weight growth of piglets up to the age of 6–8 months. However in captivity, a severe or very severe food restriction can result in a very weak growth rate (Mauget and Pépin 1985) or even a complete absence of growth and an increase of mortality (Matschke 1963). We could conclude that in Grésigne area the trophic level is generally high enough to ensure a correct growth rate in piglets, even in absence of a good oak mast. Let us also stress that, in opposition to adults, juveniles do not tend to store fat (De Vos and Sassani 1977). After a good oak mast, birth occur earlier and this fact is the only responsible of the heavier piglets observed at the next hunting season. In absence of age determination, we must be suspicious about all results concerning piglet weight growth (Ueckermann 1972; El Mastour et al. 1982).

In adult wild boars, Klein (1984) stresses that a regular weight development in males is maintained up to 2 years of age, resulting in some individuals at 100 kg in "rich" areas, as compared to 75 kg only in "poor" ones. Oldest females, in comparison, reach only 70–80 kg. Our own work confirms this dynamic in relation to sex. The fact that females tend to a step-by-step weight increase must be put in parallel with their physiology. While adult males make a very small investment in reproduction, pregnant and lactating females invest in reproduction a great part of their energy input. This investment is so great that it prevents every weight gain (except during pregnancy or after lactation when food is overabundant). The difference observed between sexes, which is established after 1 year of age (Romic 1975), could be assimilated to the part of the female energy budget which is invested annually in breeding.

Wild boars appear able to adapt themselves with a great efficiency to a sudden and unpredictable food resource, essentially by modifying the rhythm and intensity of their investment in reproduction and body development. The fact that such dynamic adjustments occur without great latency confirm the great adaptability of the species. While it seems difficult to demonstrate the realization of internal fat storage in males, we can observe in females an ability to store abdominal fat. This ability, and their capacity of using the fat reserve during adverse periods is another remarkable adaptative character highly favourable in animals establishing population strategy in free ranging conditions (Young 1976).

Acknowledgements

Many hunting organizations and game keepers have contributed at this work. We are very grateful for their efficacious help. Thoughtful comments on the manuscript were provided by A. Aumaître, F. Klein and R. Mauget. Special thanks to H. Roustan for typing.

Zusammenfassung

Fortpflanzung und Gewichtsentwicklung bei Wildschweinen (Sus scrofa) in Südwestfrankreich

Gewicht, Alter und Fortpflanzungszustand wurden bei 133 südwestfranzösischen Wildschweinen in den Jahren 1978–1980 ermittelt und zur Bestimmung der Gewichtsentwicklung in Abhängigkeit von Alter und Geschlechts sowie der Fortpflanzungszeiten verwendet. Dabei war das Alter von als Frischlinge markierten Tieren genauer bekannt, bei der Mehrzahl wurde es nach dem Linsengewicht geschätzt.

Bis zu einem Körpergewicht von 45 kg oder einem Alter von 12–15 Monaten verläuft die Gewichtszunahme bei beiden Geschlechtern gleich. Dann nehmen zunächst nur noch die Männchen gleichmäßig zu, wogegen die Weibchen ihr Gewicht erst gegen Ende der Fortpflanzungsperiode im 2. Lebensjahr erneut steigern.

Nach einem Mastjahr wurden die Jungtiere durchschnittlich früher im Jahr gebornen als nach anderen Jahren. Gleichalte erwachsene Schweine waren nach Mastjahren deutlich schwerer als nach Normaljahren, wogegen sich bei gleichalten Jungtieren kein Gewichtsunterschied nachweisen ließ. Die höheren Gewichte von Jungtieren in der Jagdzeit nach einem Mastjahr beruhen offenbar allein auf ihrem höheren Durchschnittsalter.

References

Aumaître, A.; Morvan, C.; Quéré, J. P.; Peiniau, J.; Valet, G. (1982): Productivité potentielle et reproduction hivernale chez la laie. *(Sus scrofa scrofa)* en milieu sauvage. Journées Rech. Porcine en France **14**, 109–124.

Aumaître, A.; Quéré, J. P.; Peiniau, J. (1984): Influence du milieu sur la reproduction hivernale et la prolificité de la laie. In: Symposium International sur le Sanglier. Ed. by F. Spitz, D. Pépin. Les Colloques de l'INRA, n° **22**, 71–78.

Briederman, L. (1971): Zur Reproduktion des Schwarzwildes in der Deutschen Demokratischen Republik. Tag. Ber. Dt. Akad. Landwirtsch. Wiss., Berlin, **113**, 169–186.

Dardaillon, M. (1984): Le Sanglier et le milieu camargais: dynamique coadaptative. Thèse Doct. 3ème cycle Univ. Paul Sabatier Toulouse, 1984.

De Vos, A.; Sassani, A. (1977): Eine Studie der Population des Schwarzwildes *(Sus scrofa)* in dem Mohammad Reza Shah National Park. Z. Jagdwiss. **23**, 113–126.

Duée, P. H.; Etienne, M. (1974): Influence de l'alimentation pendant la croissance de la truie sur la maturité sexuelle et les performances de reproduction: résultats préliminaires. Journées Rech. Porcine en France, 43–47.

El Mastour, A.; Perthuis, R.; Popescu, C. P. (1982): Recherches préliminaires sur la biologie et l'écoéthologie du Sanglier marocain *(Sus scrofa barbarus)*. In: Symposium international sur la gestion et la conservation de la faune sauvage méditerranéenne. C.I.C. Ed. by Bureau technique au service de la chasse, Rabat, Maroc. 36 p.

Etienne, M.; Camous, S.; Cuvillier, A. (1983): Effets de restrictions alimentaires pendant la croissance des truies sur leur maturité sexuelle et leur reproduction ultérieure. Reprod. Nutr. Dévelop. **23** (2 A), 309–319.

Etienne, M.; Legault, C. (1974): Influence de la race et du régime alimentaire sur la précocité sexuelle de la truie. Journées Rech. Porcine en France, 57–62.

Henry, V. G. (1966): European wild hog hunting season recommandations based on reproductive data. Proc. Ann. Conf. S.E. Assoc. Game and Fish Comm. **20**, 139–145.

— (1968): Length of oestrous cycle and gestation in european wild hogs. J. Wildl. Manage. **32**, 406–408.

Josse, J.; Le Denmat, M.; Martinat-Botte, F.; Saulnier, J.; Vannier, P.; Vaudelet, J. C. (1979): A propos d'une enquête sur les causes de réforme des truies. Journées Rech. Porcine en France, 365–370.

Klein, F. (1984): Contribution à l'étude de la croissance du Sanglier *(Sus scrofa)* par capture et recapture. In: Symposium International sur le Sanglier. Ed. by F. Spitz, D. Pépin. Les Colloques de l'INRA, n° **22**, 55–67.

Kozlo, P. G. (1975): The wild Boar. Minsk. 1–223. (In Russ.).

Martinat-Botte, F.; Dagorn, J.; Terqui, M.; Dando, P. (1984): Effect of confinement, climatic conditions and litter parity on the seasonal variations of the fertility rate and prolificacy. Ann. Rech. Vét. **15**, 165–172.

Martinat-Botte, F.; Dando, P.; Gautier, J.; Terqui, M. (1981): Variation saisonnière de la taille de la portée en relation avec celles du taux d'ovulation et de la mortalité embryonnaire chez la truie. Journées Rech. Porcine en France, 269–276.

Matschke, B. H. (1963): An eyelens-nutrition study of penned European wild hogs. Trans. Ann. Conf. SE Ass. Fish and Game Comm. **17**, 20–27.

— (1964): The influence of oak mast on European wild hog population. Trans. Ann. Conf. SE Ass. Fish and Game Comm. **18**, 35–39.

— (1967): Aging European wild hogs by dentition. J. Wildl. Manage. **31**, 109–113.

Mauget, R. (1972): Observations sur la reproduction du Sanglier *(Sus scrofa)* à l'état sauvage. Ann. Biol. Anim. Bioch. Biophys. **122**, 195–202.

— (1980): Régulations écologiques, comportementales et physiologiques (fonction de reproduction) de l'adaptation du Sanglier, *Sus scrofa* L., au milieu. Thèse de Doctorat d'Etat, Université de Tours, 1980.

— (1982): Seasonality of reproduction in the wild boar. In: Control of pig reproduction. Ed. by D. J. A. Cole, G. R. Foxcroft. London: Butterworths. 509–526.

Mauget, R.; Campan, R.; Spitz, F.; Dardaillon, M.; Janeau, G.; Pépin, D. (1984): Synthèse des connaissances actuelles sur la biologie du Sanglier, perspectives de recherche. In: Symposium International sur le Sanglier. Ed. by F. Spitz, D. Pépin. Les Colloques de l'INRA, n° **22**, 15–50.

Mauget, R.; Pépin, D. (1985): La puberté chez le Sanglier: étude préliminaire du rôle de l'alimentation. XVIIth Congress of Int. Union Game Biol. Ed. by S. de Crombrugghe. Brussels: Ministery of Agriculture. 191–197.

Oloff, H. B. (1951): Zur Biologie und Ökologie des Wildschweines. Beitr. Tierkd. u. Tierzucht **2**, 1–95.

Romic, S. (1975): Tjelesne dimenzije divlje svinje (Body dimensions of wild boar). Poljopr. znan. smotra **34**, 13–24 (in Czech.).

Sadleir, R. M. F. S. (1969): The ecology of reproduction in wild and domestic mammals. Lond: Methuen.

Singer, F. J.; Ackermann, B. B. (1981): Food availability, reproduction, and condition of European wild boar in great Smoky national park. Res. Mgt. Report 43. Ed. by U.S. Dep. Inter. Nat. Park. Tenn.

Solensen, A. M. Jr.; Thomas, W. B.; Gosset, J. W. (1961): A further study of the influence of level of energy intake and season on reproductive performance of gilts. J. Anim. Sci. **20**, 347–349.

Spitz, F. (1984): Démographie du Sanglier en Grésigne (Sud-Ouest de la France). In: Symposium International sur le Sanglier. Ed. by F. Spitz, D. Pépin. Les Colloques de l'INRA, n° 22, 151–157.

Spitz, F.; Janeau, G.; Valet, G. (1984): Eléments de démographie du Sanglier *(Sus scrofa)* dans la région de Grésigne. Acta Oecol. Oecol. Applic. **5**, 43–59.

Stubbe, W.; Stubbe, M. (1977): Vergleichende Beiträge zur Reproduktions- und Geburtsbiologie von Wild- und Hausschwein *Sus scrofa* L.). Beitr. Jagd- und Wildforsch. **10**, 153–179.

Sweeney, J. M.; Provot, E. E.; Sweeney, J. R. (1970): A comparison of eyelens weight and tooth

irruption pattern in age determination of feral hogs *(Sus scrofa)*. Trans. Ann. Conf. SE Ass. Fish and Game Comm., 285–291.
Ueckermann, E. (1972): Zur jagdlichen Nutzungsfähigkeit von Rot-, Dam- und Schwarzwildbeständen nach Beobachtung in einem Jagdgatt. Lev. Z. Jagdwiss. **18**, 24–31.
Vericad, J. R. (1983): Estimacion de la edad fetal y periodos de conception y parto del jabali (*Sus scrofa* L.) en los Pirineos Occidentales. XVth Cong. Int. de Fauna Cinegetica y Sylvestre. Ed. by J. Castroviejo, J. M. Blanc. Estacion, Biologica de Donana, Federacion Espanola de caza, 811–820.
Young, R. A. (1976): Fat, energy and mammalian survival. Amer. Zool. **16**, 699–710.
Zimmermann, D. R.; Spies, H. G.; Rigor, E. M.; Self, H. L.; Casida, L. E. (1960): Effect or restricted feeding, cross breeding and season of birth on age at puberty in swine. J. Anim. Sci. **19**, 687–694.

Authors' address: Dominique Pépin, François Spitz, Georges Janeau, Gilbert Valet, Laboratoire de la Faune Sauvage, et I.R.G.M., Institut National de la Recherche Agronomique, BP 27, F-31326 Castanet-Tolosan Cédex, France

Hinweise zur Kondition des Steinwildes *Capra i. ibex* im Berner Oberland (Schweizer Alpen)

Von Sylvia Zumbach und P. Lüps

Aus dem Naturhistorischen Museum der Burgergemeinde Bern und dem Jagdinspektorat des Kantons Bern[1]

Abstract

Information about the condition of Alpine Ibex Capra i. ibex in the Swiss Alps

Increasing colonies of Alpine Ibex required that the number of this protected species be regulated. In the canton of Berne 242 Ibex were shot in October of the years 1980 to 1984 in a strictly organized cull. Body weight, metatarsus marrow fat and kidney fat index showed a high correlation. The results showed that the Ibex were generally in good condition, though some deterioration in condition was observed in males older than 13 years.

Einleitung

Der Aufbau von Fettreserven in Zeiten günstiger Äsungsverhältnisse gestattet es einer Tierart, auch Perioden mit unzureichender Energiezufuhr ohne Schaden zu überstehen. Für das Steinwild ist die Einlagerung von Körperfett im Laufe des Sommers/Herbstes bekannt, wobei allerdings umfassende Zusammenstellungen fehlen. Andere Hinweise auf den konditionellen Zustand bei diesem einst nahezu ausgerotteten Vertreter der Paarhufer im Alpenraum liegen nur in sehr fragmentarischer Form vor.

Hegeabschüsse in den Jahren 1980 bis 1984 boten Gelegenheit, Daten und Material zu sammeln, mit dem Ziel, das Wissen über den Alpensteinbock zu erweitern. Zusammen mit ethologischen Aspekten sollen die Kenntnisse des konditionellen Zustandes der Tiere in den verschiedenen Kolonien eine Grundlage zur detaillierten Planung des Vorgehens bei zukünftigen Abschüssen liefern. Diese Abschüsse sind deshalb notwendig geworden, weil das Steinwild in den ständig wachsenden Kolonien Schäden am Wald, namentlich an

[1] Mit Unterstützung der Brunette-Stiftung für Naturschutz.

U.S. Copyright Clearance Center Code Statement: 0044-3468/87/5201-0030 $ 02.50/0
Z. Säugetierkunde 52 (1987) 30–38

ISSN 0044-3468